

Consolidation

Grand Trunk Railway Company of Canada.

MECHANICAL DEPARTMENT.

Montreal, 18

SPECIFICATION FOR LOCOMOTIVE ENGINE.

Main Proportions.

	SIZE.
Cylinders, style, diameter and stroke.....	<i>Horizontal, Outside, 20" x 24"</i>
Driving-wheels, number and diameter	<i>8 of 4' 2"</i>
Truck, style, number of wheels and diameter	<i>Pony - 2 of 3' 0"</i>
Boiler, style of, fuel used.....	<i>Straight back. Bituminous coal</i>
Heating surface of fire box	
Do tubes (outside diameter)	
Do total.....	
Grate, size and surface.....	$8' 0" \times 2' 10" = 22 \frac{2}{3} \text{ sq ft}$
Proportion between grate and heating surface	

Main Frame, style of..... *Bar-jointed in rear of cylinders*

Total length over all (tender included)

56' 9"

Extreme width and extreme height.....

9' 10" x 14' 9"

Total wheel base.....

46' 3 1/2"

Do do do of engine.....

22 : 4

Do fixed do do (flanged).....

14 : 8

Centres.

First Axle to second

5' : 1

Second do do third.....

4 : 9

	SIZE.
Centres.—Continued.	
Third do do fourth.....	$5\frac{1}{4}$
First do do truck centre.....	$7: 2$
Truck Axle centres.....	
Centre of axle to face of throat plate.....	$2: 2 \frac{3}{8}$
Do driving axle to centre of cylinder.....	$13: 9$
Do do do to centre of reversing shaft.....	$5: 9$
Do do do to face of motion plate.....	$7: 7 \frac{7}{8}$
Do do do to centre of rock-shaft.....	$7: 0 \frac{1}{2}$
Tender.	
Water capacity in Imperial gallons.....	<u>3,000</u>
Fuel do in short tons and cub. ft.....	<u>7 tons = 280 cub. ft.</u>
Frame, style of.....	<u>Bent channel iron - 4 bars</u>
Trucks.....	<u>Iron</u>
Truck centres and axle centres.....	<u>10' 6" and 4' 8"</u>
Total wheel base.....	<u>15: 2</u>
Total length over all.....	
Nos. of the chief drawings, viz.:	
General plan, 1480 boiler, 1577 frame 1525.....	
Cylinder, 1486 wheel and axle 1544 truck, 1579 tender 1578.	
Boiler Material.	
Barrel, dome, outside fire box.....	<u>Steel to N° 1 Specification</u>
Inside fire box.....	<u>Crown, front and back of steel Specif. N° 1. Remainder iron N° 1</u>
Front tube sheet.....	<u>Iron N° 1 Specif.</u>
Smoke box.....	<u>Iron N° 3 - do -</u>
Foundation-ring, stays.....	<u>Ring - iron N° 3. Stay iron N° 1</u>
Rivets, bolts, screwed stays.....	<u>Iron N° 4 Specif.</u>
Angle iron.....	<u>Iron N° 1 - do -</u>
Tubes.....	<u>Iron - to tube specification</u>

Boiler Barrel.	Telescopic and Straight back	SIZE.
Shape and style.....		
Length, throat to tube plate.....		12': 10"
Outside diameter, largest and smallest		4': 8 $\frac{1}{2}$ " and 4': 6 $\frac{3}{4}$ "
Height from rail to centre.....		6': 5"
Plates, thickness of, in barrel.....		Steel $\frac{7}{16}$ "
Joints, longitudinal.....	<i>lap</i>	
Do circular.....		{ $\frac{1}{8}$ " rivets - double riveted
Dome, inside diameter and height.....		2': 2 $\frac{1}{8}$ " x 2': 8"
Do cover.....		
Do top ring.....		
Studs for do		
Tube plate, front, style of	<i>Circular and flanged for smoke box</i>	
Do diameter and thickness		5': 2 $\frac{7}{8}$ " out. flange x $\frac{5}{8}$ "
Do angle iron ring.....		3 $\frac{1}{4}$ " x 3 $\frac{1}{4}$ " x $\frac{1}{4}$ "
Gusset stays, front end.....		Six of 3" angle iron and $\frac{1}{8}$ " plate
Do fire box end.....	<i>Do</i>	do do do
Crown stays, style and shape.....		330 plain screwed bolts
Do size of.....		$\frac{1}{8}$ " dia, 12 threads per in.
Outside Fire Box.		
Length, outside.....		8': 9 $\frac{5}{8}$ "
Width do at bottom.....		3 : 6
Do do at centre line.....		4 : 9 $\frac{3}{8}$ "
Greatest depth.....		6 : 6 $\frac{11}{16}$ "
Least depth (for inclined grate).....		5 : 6 $\frac{3}{16}$ "
Outside crown above barrel centre line.....		2 : 4 $\frac{11}{16}$ "
Plates, thickness of.....		$\frac{3}{8}$ ", throat plate is $\frac{7}{16}$ "

Outside Fire Box.—Continued.

	SIZE.
Rivets and their pitch.....	$\frac{1}{4}$ " dia. \times 2" pitch
Hollow stays.....	One row all round, $\frac{1}{8}$ " hole.
Screwed stays for water space and their pitch.....	$\frac{7}{8}$ " dia. 12 threads, 4" centres
Fire hole, shape.....	square, rounded corners
Do size inside	$16" \times 16"$
Centre above grate level.....	$1:7\frac{1}{4}$
Do to barrel centre.....	$1:1\frac{1}{4}$
Do to bottom of box	$2:0\frac{1}{4}$

Inside Fire Box.

Water space, front, back, and sides	$2" \text{ to } 4", 4" \text{ and } 3\frac{1}{4}$
Foundation ring sizes.....	$2\frac{1}{4}$ " deep, flange $2\frac{3}{4} \times 1\frac{1}{8}$ "
Length of box, inside, at bottom and at top.....	$8'0" \text{ and } 10'6"$
Width do do do do	$2:9\frac{1}{8}$ and $3:11\frac{1}{4}$
Depth do do at front and at back.....	$3:10$
Inside of crown above centre line of Boiler	$11\frac{1}{4}$ " front, $8\frac{1}{2}$ " back
<i>crown</i>	
Clear space between centre sheets, back and front.....	$1:7\frac{1}{4}$ " front and $1:4\frac{1}{2}$ " back
Top of grate above ring	
Crown plate, thickness..	$\frac{3}{8}$ " steel
Side plates, do	$\frac{3}{8}$ " iron
Back plates, do	$\frac{5}{16}$ " steel
Tube plate, do	$\frac{1}{2}$ " steel, throat $\frac{7}{16}$ "

Tubes.

Number and length between tube plates.....	$201 - 10': 8\frac{3}{16}$ "
Diameter and thickness.....	<i>Drawn</i>
Vertical centres (apart).....	$2\frac{5}{8}$ "
Horizontal centres (apart).....	$4\frac{5}{8}$ "

Tubes.—Continued.		SIZE.
Diagonal	do	(do).....
Smallest clearance between each tube.....		$\frac{1}{16}$
Average weight of each tube.....		
Internal test pressure (hydraulic)		250 lbs per square inch
Style of joints.....	Plain, expanded at front, outside ferrules back.	
Ferrules.....	Outside of Copper. 201-1" long x 2" int. dia. x 1/16 B.W.G.	
Fire Grate.		
Style of.....	2 sets of rockers, and one set of fixed bars	
Width of bars and spaces.....	Various. See detail	
Number of sets of bars.....	do	do
Rods for working.....	do	do
Lever do } of wra't iron.....	do	do
Handle do }	do	do
Ash Pan.		
Style of.....	Double pocket -	
Size		do
Thickness of plates.....	$\frac{1}{4}$ " iron 1 $\frac{1}{2}$ Specifi	
Size and pitch of rivets.....	$\frac{1}{2}$ " x 1 $\frac{1}{2}$ "	
Angle-iron frame.....	2 x $\frac{3}{8}$	
Do supports.....		
Other supports.....	}	
Number of dampers.....	of wra't iron	
Damper rods.....	Two and two doons	
Do levers.....		

	SIZE
Smoke Box.	
Style of.	Cylindrical, butt longitudinal jointed, rivet heads counterclockwise
Diameter outside.....	5': 2 $\frac{3}{8}$ "
Length from tube plate.....	3 : 0 $\frac{1}{4}$
Thickness of metal	$\frac{7}{16}$ "
Rivets at front, do back, do horizontal.....	
Door ring	Wrought iron
End plate	
Inner smoke box	
Door opening.....	
Door, style of.....	
Door fastenings.....	
Chimney.	
Style of.....	
Total height from barrel, do from rai.....	5': 9 $\frac{13}{16}$ and 14': 9 "
Diameter, smallest inside, and largest do.....	1: 7 $\frac{5}{8}$ and 2: 2 $\frac{5}{8}$
Plate, thickness of. Best Pennsylvania iron. No 9 B. W. G.	
Rivets, diameter and pitch.....	$\frac{5}{16}$ " x 1 $\frac{1}{4}$ "
Cone.....	
Do stays.....	
Boonet, style of.....	
Do diameter and height.....	
Do bolts.....	
Netting, size.....	
Do style of.....	
Base castings.....	
Bolts for same.....	
Straight stack coping.....	Not used

Truck.	SIZE.
Style of.	Pony, 2 Roller centre, transverse springs
Axles	Wrot iron, to axle specification
Number and material	One, well keyed to wheel
Journals, centres x diameter x length	
Wheel seat, diameter x length	
Total length x diameter at middle	
Collars, number x diameter x thickness	
Do do do do	
Truck Wheels.	
Number, diameter and material	2 of 36" of wrot iron
Hub, diameter x thickness	
Tyre, style of	Manrell clip of Approved steel
Do sizes of	3" x 5 $\frac{1}{4}$ "
Truck Axle Box.	
Style and material	Cast iron, with spring bearers at side
Length x depth x thickness	
Brass for journal	1 $\frac{1}{4}$ " x 8 $\frac{3}{8}$ " x
Sponge box	
Bolts for same	
Truck Frame.	
Style of	
Side frame	
Pedestals	
Sizes of	
Cross frame	
Sizes of	

Truck Frame.—Continued.

	SIZE.
Springs, style of.....	2 Transverse
Do sizes of.....	
Spring buckles.....	
Do shoes.....	
Shoe bolts.....	
Compensating beams.....	} None
Stirrups for same.....	
Moveable saddle.....	
Links and pins for same.....	
Rollers.....	<i>2 of chilled iron or cast steel</i>
Engine centre for truck.....	<i>Cast iron</i>
King pin.....	
Check chains.....	<i>Wrought iron 1 1/8" dia.</i>

*Main***Frame.**

Style of.....	Jointed - Bar
Material of.....	<i>Wrought iron to B-3 Specification</i>
Centres apart, transversely.....	3' 11"
Distance between metal transversely.....	3 : 7
Cross-section at cylinder, inside pedestals, between axles.....	<i>3 1/2" x 4" and 4" x 4" and 3" x 4"</i>
Section of lower frame straps.....	<i>3 3/4" x 2 1/2" not planed</i>
Feet for same.....	<i>1 1/4" x 3 3/4" x 1 1/4"</i>
Bolts do	<i>1 1/4" dia. countersunk heads</i>
Section of pedestal at top, do at bottom.....	<i>4" x 2 3/4" and 4" x 3 3/4" and 4" x 2"</i>
Pedestal straps.....	<i>3 3/4" x 1 1/2"</i>
Bolts for same.....	<i>1" dia. studs</i>
Bolts for wedges	<i>1 1/4" x 8 3/8"</i>

NAME.—Continued.	SIZE.
Wedges.....	$14'' \times 5'' \times \frac{3}{8}''$ to $1\frac{1}{4}''$, with $\frac{1}{4}''$ flanges
Wedge faces.....	None
Pedestal faces.....	$1\frac{1}{2}'' \times 5'' \times \frac{3}{8}''$, with $\frac{1}{2}''$ flanges
Frame joint, style of.....	Horizontal, bolted and keyed
Do size of.....	$1\frac{1}{8}''$ long
Bolts for same.....	4 of $1\frac{1}{8}''$ to each
Keys do	3 of $1\frac{1}{2}'' \times 1'' \times 4''$
Diagonal struts, front.....	} see detail
Do back.....	
Cross piece, front.....	$7\frac{1}{2}'' \times 6'' \times 2''$ do x do x do bent
Do back, top.....	
Do do lower.....	$\frac{5}{8}'' \times 4\frac{1}{4}'' \times 1\frac{1}{4}''$
Transverse stays.....	$7\frac{1}{2}'' \times 6'' \times 5\frac{1}{4}''$
Brackets for same, to frame.....	wrought iron
Bolts for bracket.....	4 of 1" and 8 of $\frac{3}{4}''$
Angle iron.....	$2\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{1}{4}''$
Transverse stay, bar.....	footed
Bolts for same.....	$1'' \times 4'' \times 4\frac{1}{4}''$ 2 of 1"
Transverse frame for truck.....	2 Bars $5'' \times 1\frac{1}{4}''$
Feet for same.....	$4'' \times 3\frac{3}{4}'' \times 3''$
Bolt for feet.....	4 of 1"
Belly Stay.	Transverse for compensating lever
Total length x depth x thickness.....	$4\frac{1}{4}'' \times 4\frac{1}{4}'' \times 5\frac{1}{4}'' \times 1\frac{1}{2}''$
Angle iron for same.....	$7\frac{1}{2}'' \times 3\frac{1}{2}'' \times 7\frac{1}{4}'' \times 1\frac{1}{8}''$
Bolts for angle iron.....	$3'' \times 3'' \times 3'': 9''$ unbent
Bracket to frame, of wrought iron.....	9 of $\frac{3}{4}''$ dia.
Bolts to belly stay.....	$13'' \times 11\frac{1}{4}'' \times 5\frac{1}{2}'' \times 1\frac{1}{4}''$ and $1\frac{1}{8}''$ 10 of $\frac{7}{8}''$ dia. $\times 3\frac{5}{8}''$

Buffer Beam, &c.		Size 9' 0" x 10" x 9 $\frac{1}{4}$ "
Size and material.....	Oak	
Frame bracket.....		
Frame bolts.....		
Draw casting and bolts.....		
Push bar.....		
Pilot.....	of Oak or Ash	
Stays for same.....		
Front foot plate.....		
Diagonal stays to smoke box.....	of wrought iron	2 $\frac{1}{4}$ " dia, see detail
Rear Foot Plate.		
Style of.....		
Size of plate.....		
Draw casting.....		
Draw pin.....		
Draw link.....		
Rubbing piece.....		
Bracket carrying cab.....		
Footstep and bracket.....		
Axles—Main Driving.		
Number and material of.....	4 of wrought iron to axle specification	
Journals, centres x diameter x length.....	3' 11" x 6 $\frac{1}{2}$ " x 7 $\frac{1}{2}$ "	
Wheel seat, diameter x length.....	7" x 6 $\frac{1}{2}$ "	
Total length x diameter at middle.....	5' 8 $\frac{3}{4}$ " x 6 $\frac{1}{2}$ "	
Collars, number and diameter x thickness.....	2 of 10" dia. x 1 $\frac{1}{4}$ " drives	
Do do do do do	2 of 10" do. x 1 $\frac{1}{2}$ " 1 $\frac{1}{2}$ + 2 $\frac{1}{2}$	
Eccentric seat, diameter x thickness.....	2 of 9 $\frac{1}{4}$ do. x 1 $\frac{1}{2}$ " trailing → 6 $\frac{3}{4}$ " x 6 $\frac{1}{4}$ " long	

Wheels—Main Driving.

	SIZE.
Number and material	8 of Cast iron
Diameter outside	$4\frac{1}{2}$ " - Centres are $3\frac{1}{8}$ "
Rim, size of	$5\frac{1}{2}$ " wide
Spokes, number and shape	13 , hollow, oval,
Spokes, cross section	$4\frac{1}{4}'' \times 2\frac{7}{16}''$ and $\frac{5}{8}''$, $\frac{13}{16}$
Hub, outside diameter \times thickness	$1\frac{3}{4}'' \times 7''$
Inside diameter and key	$6\frac{1}{2}'' - 1\frac{1}{4}'' \times 1''$
Crank hub, outside diameter \times thickness	$12\frac{1}{4}'' \times 6\frac{7}{8}''$
Balance weights	Cast in centres
Tyres, material and style	Approved steel , outside clip
Tyres, size of	$6\frac{1}{2}'' \times 3'' - 5\frac{1}{2}'' \times 3''$
Tyre fastenings	4 of $1'' \times 3\frac{1}{8}''$ tapped bolts
Number flanged, number not flanged	4 flanged and 4 not.

Crank Pins—Driving.

Hub seat, diameter \times length	$5\frac{1}{4}'' \times 6\frac{7}{8}''$
Collar first, do \times do	$6 \times \frac{1}{4}$
Journal first, do \times do	$5\frac{1}{4} \times 4\frac{1}{2}$
Collar second, diameter \times length	$6 \times \frac{1}{2}$
Journal second, diameter \times length	5×5
Collar third, do \times do	$6 \times \frac{5}{8}$
Hub to centre of first journal	$2\frac{1}{2}$
Centres of journals	$5\frac{1}{4}$

Crank Pins—not Driving.

Hub seat, diameter \times length	$4\frac{1}{2} \times 6\frac{7}{8}''$
Collar first, do \times do	$5 \times \frac{1}{8}$
Journal, do \times do	$4 \times 3\frac{1}{2}$
Collar second, do \times do	$5 \times \frac{1}{2}$

	SIZE.
Axle Boxes—Main Axles.	
Length x depth x thickness.....	$13'' \times 14'' \times 7\frac{1}{2}''$
Flanges for Pedestals.....	$1\frac{1}{8}''$ thick
Journals, bearing, metal, and thickness.....	Gun metal $1\frac{1}{4}''$ thick
Sponge Box	$4\frac{1}{8}''$ deep
Bolts for same.....	$\frac{1}{2}'' \times 1\frac{3}{4}''$ cotteded
Spring shoe.....	Cast iron
Springs.	<i>Approved steel.</i>
Material.....	$3\frac{1}{2}'' \times \frac{3}{8}''$
Size of plates.....	5 ft. centres, 11 plates
First axle, length and number.....	do do do do
Second do do do	do do do do
Third do do do	do do 12 do
Fourth do do do	do do do do
Buckles	<i>Wrought iron.</i>
Links.....	$2\frac{1}{2}'' \times \frac{3}{4}'' \times$
Steel cotters.....	
Rubber pads.....	
Plates for same	
Cotters for same.....	
Compensating levers, longitudinal.....	
Sizes of.....	
Brackets for levers.....	
Cotters for brackets	
Bolts do do	
Compensating lever, transverse	
Frame for same.....	
Bolts do do	

Motion.	SIZE.
Eccentrics, material and number.....	4, split, of cast iron
Diameter x thickness x throw	14 $\frac{1}{2}$ " x 3" and 5" throw
Bolts, studs, keys, and cotters.....	
Straps	Cast iron
Bolts.....	2 of 1" x
Oil cups	Cast iron - Screwed cover
Eccentric rods.....	Bent wrought iron 5 $\frac{1}{2}$ " x 1" x 2 $\frac{1}{2}$ " to 3 $\frac{1}{2}$ "
Butt end and bolts.....	8 $\frac{1}{4}$ " x 2 $\frac{1}{4}$ " x 1 $\frac{1}{4}$ ", each two 1" x
Cross sections of rod.....	3 $\frac{1}{2}$ " x 1" and 2 $\frac{1}{2}$ " x 1"
Jaw end	4" x 2 $\frac{1}{2}$ " with $\frac{3}{4}$ " sides
Bolts	7/8" x 5"
Ferrules	Steel 1 $\frac{1}{8}$ " out. dia. x 2 $\frac{1}{2}$ "
Radius link.....	Wrought iron - Solid forged
Length inside, centres and thickness.....	1 $\frac{1}{2}$ " x 6 $\frac{3}{4}$ " and 1 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ "
Link block, length x width.....	5" x 2 $\frac{1}{2}$ " x 2 $\frac{15}{16}$ "
Link side-bracket.....	3" x 7 $\frac{5}{8}$ " x 1 $\frac{1}{2}$ "
Bracket pin.....	1 $\frac{1}{2}$ " dia. x 3 $\frac{3}{4}$ "
Bracket bolts.....	7/8" dia. countersunk heads
Suspension link.....	
Length x cross sections	1 $\frac{1}{2}$ " x 4 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " x 7/8"
Top bearing.....	1 $\frac{1}{2}$ " x 3", outside 2 $\frac{1}{2}$ " dia.
Lower do	1 $\frac{1}{2}$ " x 3 $\frac{3}{4}$ ", outside 2 $\frac{1}{2}$ " dia.
Top do bolt.....	6 $\frac{3}{4}$ " x 1 $\frac{1}{2}$ " and 1 $\frac{1}{4}$ " dia.
Reversing shaft.....	Solid forged levers
Diameter and length.....	3 $\frac{1}{4}$ " x 4": 3"

Motion.—Continued.	SIZE.
Horizontal lever.....	$1\frac{1}{4}'' \times 1'' \times 2\frac{1}{2}''$ to $4''$
Vertical do	$1\frac{1}{6}'' \times 1'' \times 3$ to 4
Short do	$3\frac{1}{2}'' \times 1\frac{1}{2}'' \times 2$ to $3\frac{1}{4}$
Shaft journals x centres.....	$2''$ dia. $\times 4'' \times 3\frac{1}{11}''$
Journal brackets.....	Cast iron
Bracket bolts.....	4 of $\frac{7}{8}'' \times 2\frac{1}{2}''$
Reversing spring.....	Steel - half elliptic
Size of	4 plates $4'' \times \frac{1}{8}'' \times 3\frac{1}{2}''$; 5" long
Bracket for ends.....	Cast iron
Bolts for bracket to frame.....	4 of $\frac{3}{4}'' \times 1\frac{5}{8}''$
Reversing spring buckle.....	Cast iron
Buckle coupling and pin	$3\frac{3}{4}'' \times 2\frac{1}{4}'' \times 2\frac{1}{4}''$ long $1\frac{1}{2}'' \times 2\frac{1}{2}''$
Rod to short lever.....	$6'' \times 2\frac{1}{2}''$, pin $\frac{3}{4}'' \times 3\frac{1}{2}''$
Coupling and pin	$2\frac{1}{2}'' \times 2\frac{1}{8}'' \times 1''$ dia. and $1\frac{1}{4}''$ dia.
Rod to cab.....	$6'' \times 2\frac{1}{2}''$, pin $\frac{3}{4}'' \times 3\frac{1}{2}''$
Reversing handle.....	$3'' \times \frac{7}{8}'' \times$ about $13\frac{1}{2}''$; $9\frac{1}{4}''$
Long end and short end.....	
Lower pin.....	
Upper pin.....	
Quadrant	
Brackets for same.....	
Bolts for same.....	
Rocker	Solid forged
Journal of rocker.....	$3\frac{1}{2}'' \times 12\frac{7}{8}''$
Rocker box.....	Cast iron, babbitted.

Motion.—Continued.

	SIZE.
Bolts for box	3 of $\frac{7}{8}$ " and 2 of 1"
Lower rocker arm	$10\frac{1}{2} \times 1\frac{1}{2} \times 3$ " to 5" wide
Upper do do	do \times do \times do do
Pin, upper arm	$1\frac{1}{4}$ " and $1\frac{1}{2}$ " dia \approx \times $9\frac{3}{4}$ "
Valve rod journal	$1\frac{3}{4}$ " \times 4"
Valve rod	$1\frac{1}{4}$ " and $1\frac{1}{2}$ " dia \approx \times 4: $7\frac{1}{2}$ "
Joint for same	<i>Rivet</i>
Valve stem	$6\frac{1}{2} \times 3 \times 3\frac{1}{4} \times 2\frac{1}{4}$ " dia.
Valve buckle, inside	$1\frac{1}{2}$ " dia. \times 3': 1" over all
	$18\frac{1}{4} \times 6\frac{1}{2}$ ", section $\frac{1}{2} \times 2\frac{1}{2}$ "

Slide Bars.

Material and number	Steel - 4
Length \times cross sections	$4: 4\frac{3}{8}$ " and 3" \times $4\frac{1}{2}$ " at centre
Bolts to belly stay	4 of $1\frac{1}{2} \times 4\frac{3}{8}$ "
Bolts to front bracket	4 of $1\frac{1}{2} \times 5\frac{3}{4}$ "
Front bracket	Wash. $6\frac{1}{2} \times 4" \times 2"$
Bolts, bracket to cover	$1" \times 7\frac{1}{4}$ " countersunk
Oil cups	Glass - needle feed

Cylinders.

Style and Material	Horizontal - with half saddle - hard cast iron
Diameter \times stroke	$20" \times 24"$
Cylinder centres, spindle centres	$7:0" \text{ and } 6:6"$
Boiler centre to cylinder centre, cylinder centre to spindle centre	$4:3" \text{ and } 1:6\frac{1}{8}$ "
Barrel, thickness \times length	$1\frac{1}{8} " \times 2:8"$
Bolts, saddle to frame	22 of $1\frac{1}{8}$ " dia
Bolts, saddles together	17 do do
Bolts, saddles to smoke box	20 do do

Cylinders.—Continued.

	SIZE.
Front flange.....	2 $\frac{1}{2}$ " x 1 $\frac{3}{8}$ "
Back do	do x do
Valve face	19 $\frac{1}{4}$ " x 10 $\frac{1}{2}$ "
Steam ports	17 $\frac{1}{4}$ " x 1 $\frac{1}{4}$
Bridges between ports.....	1" x 2" deep
Exhaust ports	17 $\frac{1}{4}$ " x 2 $\frac{1}{2}$ "
Steam chest.....	Square, loose, Cast iron
Sizes inside, do outside, depth.....	17 $\frac{1}{2}$ " x 19 $\frac{1}{2}$ " and 19 $\frac{1}{2}$ " x 21 $\frac{1}{2}$ ", and 5 $\frac{1}{2}$ " deep
Front glands.....	Gun metal
Studs for same.....	8 of $\frac{3}{4}$ "
Back gland	Gun metal
Studs for same.....	4 of $\frac{3}{4}$ "
Back bushes.....	
Cover for chest.....	1: 11 $\frac{1}{2}$ " x 2: 1 $\frac{1}{2}$ " x 1 $\frac{1}{4}$ " with websec
Studs for same.....	each 20 of 1" x 10"
Top casing.....	Cast iron - left black
Side casing.....	do - do
Barrel casing.....	Russian iron, Brass screws
Barrel cleaving.....	Dry pine
Tallow cup, or pipe.....	
Slide valve	Hard cast iron
Travel, lap and lead	5" and $\frac{3}{4}$ " and $\frac{1}{16}$ "
Length x width x depth of same.....	19 $\frac{1}{4}$ " x 8 $\frac{1}{2}$ " x 4 $\frac{1}{4}$
Valve cavity, length x width x depth.....	17 $\frac{1}{4}$ " x 4 $\frac{1}{2}$ " x 3 $\frac{3}{4}$

Cylinder Covers.	SIZE.
Front covers.....	2': 2" x
Studs for same.....	13 of $\frac{7}{8}$ " x each
Front casing.....	Cast iron. $\frac{3}{8}$ " thick, left black
Back covers.....	22" x $1\frac{1}{4}$ "
Studs for same.....	each 13 of $\frac{7}{8}$ " x
Back flange on cover.....	1': 6 $\frac{1}{8}$ " x 2" thick for bolts
Back casing.....	Cast iron, $\frac{3}{8}$ " thick, left black
Piston rod gland.....	Gum metal
Studs for same.....	Gum metal
Piston rod bush.....	Gum metal
Piston and Rod.	
Head, style of.....	Hollow - Cast iron - 3 grooves
Depths at centre and rim.....	5 $\frac{1}{2}$ " and $4\frac{3}{4}$ "
Thickness of walls.....	$\frac{3}{4}$ "
Size of hub.....	7" dia
Piston rings, style of.....	Cast iron - cut & sprung in
Number and size of.....	3 of $\frac{5}{8}$ " x $\frac{1}{2}$ "
Piston rod.....	Approved steel
Diameter x total length.....	$3\frac{1}{4}$ " x 4': 2 $\frac{3}{4}$ "
Rod cotter.....	$3"$ x $\frac{5}{8}$ "
Screwed end with nut.....	$2\frac{3}{4}$ " x
Taper end in crosshead.....	$8"$ x 3" to $2\frac{5}{8}$ "
Cross Head.	
Style of.....	Cast iron box
Length x depth x width.....	Bars top and bottom 23 x 13 x 6

Cross Head.--Continued.

	SIZE.
Gibs.....	<i>Gun metal</i> $23 \frac{1}{2} \times 4 \frac{1}{2} \times \frac{1}{2}$ "
Surface bearing on one slide bar.....	$23 \frac{1}{2} \times 4 \frac{1}{2} = 103 \frac{1}{2}$ sq. inches
Wrist pin.....	<i>Woot iron. Case hardened</i>
Pin journal.....	$3 \frac{1}{8} \times 3 \frac{1}{8}$ long

Pumps.

Material and style of.....	
Diameter \times stroke \times capacity per stroke.....	
Length to centre, length total.....	
Diameter inside and outside.....	
Gland and bush.....	
Gland studs.....	
Top chamber.....	
Lower do.....	
Top clack.....	
Lower do.....	
Top case.....	
Lower do.....	
Frost cocks.....	
Pet cocks.....	
Chamber bolts.....	
Frame bolts.....	
Plunger.....	
Delivery clack.....	
Do case.....	
Do casing.....	

None required
as two N^o 8
injections are
used

Connecting Rods.

	SIZE.
Style and Material	Iron - with straps
Length, centres and cross sections.....	9:7"-3½"×2½" and 4½"×2½"
Small-end straps.....	3"×1¼"×
Do coppers and bolts.....	2½"×7", bolts 1½"×
Do brass.....	Brass 3"×3"
Oil cups	Glass cups - needle feed
Large-end straps.....	3½"×1¼"
Do coppers and bolts.....	2"×1" and bolts 1½"×
Do brass.....	Brass 5"×5"
Oil cups and cellars.....	Glass cups - Brass cellars

Side Rods.

Style and Material.....	Solid ends - Iron
Lengths, centres.....	5': 1"-4': 9"-5'; 4"
Cross sections.....	5"×1½" and 5"×1¼" - 5"×1½"
Cotters	2 ½"× ¾"
Brasses	Brass
Joints	2 - See detail
Joint pins.....	3" dia. case hardened
Joint bushes.....	Steel. 3½" out. dia. × 2"
Oil cups	Glass. Needle feed
Oil cellars.	Brass.

Exhaust Pipe.

Material and style.....	Cast iron - double
Diameter at top and bottom.....	6½" bottom and top
Height	10"
Attachments to saddle.....	
Nozzle.....	

Steam Pipe.

Material and style	<i>Cast iron</i>	Size.
Ring joint to saddle.....	<i>Bree</i>	<i>Double - Curved</i>
Sizes of pipe.....		<i>Ground Ball joint</i>
" Tee " connection		
Bolts for " Tee "		
Dry pipe.		<i>Wrot iron</i>
Sizes of.		<i>6 $\frac{1}{2}$" int. dia x</i>
Joints.....		
Bend at dome.....		
Upright in dome		
Supports		
Valve cage.....		
Valve, style of.....		<i>Double poppet</i>
Valve, sizes of.....		<i>5 $\frac{1}{2}$" and 4 $\frac{1}{2}$" dia</i>
Upright valve rod.....		<i>Wrot iron</i>
Crank for same.....		
Regulator rod.....		

Regulator.

Gland.....	<i>Bree</i>
Gland bush.....	
Handle, style of.....	
Do sizes of	
Bracket for handle	

Cab, &c.

Material and style..	<i>Ash or Walnut</i>
Size of.....	<i>7:0" x 8:6"</i>

Cab, &c.—Continued.**SIZE.**

Windows.....	
Glass	
Doors.....	
Cushions	
Roof.....	
Roofing	

General Fittings.

Side foot-boards.....	
Brackets for same.....	
Splashers—main wheels	
Angle iron for same	
Splashers—truck wheels.....	
Splasher moldings.....	
Head-lamp brackets.....	2 - Cast iron
Signal lamp do	1 on tender and 1 on cab smoke box
Boiler sheeting	Russia iron - Dark bands
Boiler lagging	Dry pine $\frac{3}{8}$ " thick well nailed
Bands for same	
Cylinder sheetings.....	
Do lagging.....	
Do bands	
Blower or jet cock.....	
Tap and lever for blower.....	
Rod for tap	
Hand rail.....	
Brackets for rail.....	

General Fittings.—Continued.**SIZE.**

Pet cock rod and handle.....	
Bell.....	
Saddle for bell.....	
Bell stand.....	
Sand-box, shape and style	
Size of sand-box.....	
Sand valve	
Rod for sand valve.....	
Casing for dome	
Fittings for casing.....	
Whistle	
Rods and levers for same.....	
Pressure gauge	
Gauge stand or bracket.....	
Lamp stand for same	
Heater cocks.....	
Water gauge brackets	
Water gauge tube.....	
Water gauge lamp stand.....	
Gauge cocks.....	
Drip pipe and dish.....	
Blow-off cock.....	
Rod and lever for same.....	
Lazy cocks.....	
Rod and handle for same.....	

General Fittings.—Continued.

	SIZE.
Fire hole door.....	
Tray for tallow can.....	
Safety valve locked.....	
Safety valve.....	
Cylinder cocks.....	
Rods and lever for same.....	
Tallow cups.....	
Gong in cab.....	
Fusible plugs.....	
Wash-out plugs.....	
Fire brick arch.....	
Supports for same.....	
Baffle plate.....	
Lettering or numbering.....	
Rubber pipe and branch.....	
Pipe to ash-pan.....	

Injectors—maker..... *Sellers Self Adjusting*
 Number, size and material *Two of N^o 8 Brass body*

Pipes.

DESCRIPTION.	MATERIAL.	No. required per Engine.	Internal Diameter.	Thickness in B. W. G.
Feed.....				
Delivery.....				
Pump to cab.....				
Injector—steam.....	<i>Copper</i>	2		
Waste water.....	<i>Copper</i>	2		
Delivery.....	<i>Copper</i>	2	2"	7

Pipes.—Continued.

DESCRIPTION.	MATERIAL.	No. required per Engine.	Internal Diameter.	Thickness in B. W. G.
Feed	Copper	2	2"	7
Dry pipe	Iron	1		
Tallow to cylinder	Brass	2		
Steam jet pipe	Iron	1		
Boiler tubes	Iron	201	1.78	12
Heaters	Brass	2		
Blower or jet	Iron	1		
Sand pipes	Brass	2		
Pressure gauge	Copper	1		
Drip pan	Copper	1		3/8"

Tools.

		SIZE.
Screw jacks—plain	with stout base.	2 Bottle, 2 1/2" screw
Do traversing		2, 2 1/2 "
Chains	Two 5/8' dia x 12' 0" with hook and 3" ring at ends	
Wrenches	6 double ended.	steel
Gland packing irons		1 set
Monkey wrenches		1 of 16" and 1 of 10"
Hammers	1 Heavy coal, 1 of 2 1/2 lbs, 1 of 10 lbs, double face	
Flat chisels		3 - of steel
Tube plugging irons		1 set
Tube plugs		12, turned taper
Fire pricker		1 of 7/8" x 12' 6"
Fire dart		1 of 1" x 12' 6"
Fire shovel	Steel blade, socket, ash handle	
Bricks	One fire brick Arch complete	

Tools.—Continued.

	SIZE.
Pinch bars 1 of Motivian, steel footed & pointed, 6 ft. \times $1\frac{1}{2}$ " sq to $1\frac{1}{8}$ " round	
Torches	2 with brass cases
Oil can	1 of $2\frac{1}{2}$ gals and 1 of 1 gal.
Oil feeders	1 of 4 lbs. and 1 of 2 lbs
Tallow feeders	1 of 2 lbs
Tallow can	1 of 8 "
Signal lamps	2 lights — 1 in front and 1 at back
Cab lamps	2 for gauges
Head do 1 of Kelly, Philadelphia Co. Danville or Chanteloup - 22 reflector	alt.
Axe,	1 of $5\frac{1}{2}$ lbs.
Saw	1 of 26" blade
Tool chests with stout hinges and locks	2 on tender, 2 in cab
Flag and staff	1 red and 1 white
Flag stands	2 cast iron, on buffer beam

TENDER.

Tank.

Material of	Iron No 3 Specifi
Length \times breadth \times depth	$20:0" \times 8:4" \times 3:9"$
Horse shoe depth \times width	$10:3" \text{ top and } 7:1" \text{ bottom} \times 4:0"$
Coping	$19:0" \text{ long} \times 9:6" \times 10" \times \frac{1}{4}"$
Beadings	half round $\frac{1}{2}" \times 1\frac{1}{4}" \times 40$ ft.
Plates, bottom and top	$\frac{3}{8}" \text{ bottom, } \frac{1}{4}" \text{ top}$
Plates, sides and horse shoe	$\frac{3}{16}" \text{ sides, } \frac{1}{4}"$
Angle-iron	$2" \times 2" \times \frac{3}{8}"$
Cross stays	$3 \times \frac{9}{16}" \text{ and } \frac{9}{16} \times 3:9" \times 10:6"$
Rivets, diameter \times pitch	$\frac{1}{2} \times 1\frac{1}{2}" \text{ for tank}$ $\frac{1}{2} \times 3\frac{1}{2}" \text{ " stays}$

Tank.—Continued

SIZE.

Brackets to hold down	} None required
Bolts for same	
Coal boards	1 back and one front of pine
Brackets for same 4 angle irons 2" x 3" x 2 1/2" and 2 do. 2 1/2" x 2 1/2" x 9" x 2 bent	
Manhole 4" plate, double 2" flange, 1 1/2" dia. x 10" deep	stop. }
Cover for same 4" dia. 1 1/2" dia, wrot iron handle 1 1/2" angle iron ring	
Strainer do Sheet wire, 3/8" dia x 1/4" pitch 2 1/2" deep x 1 1/2" dia.	
Hand rail.....	2 Wrot iron polished 7/8" dia. x 2 ft.
Feed valve.....	of brass, cage and seat cast iron
Casting for pipe.....	iron see detail
Feed rod and handle.....	Wrot iron. 7/8" dia., 1/4" coupling pin
Catch for handle.....	Cast iron, notched and recessed
Carrying brackets for Tank - 8 of cast iron 6" x 6" x 4"	
Bolts for same	16 of 5/8" dia
Moulding.....	None required, edge of floor plate rounded
Flooring.....	formed by bottom tank plate with 10 holes 3/8" dia. to drain

Frame.

Style of.....	Wrot iron, square front, round ends, of channel iron
Length x width.....	21' 1" x 7' 9"
Cross section of metal	6" x 2 7/8" flanges x 9/16", weight 56 lbs per yard
Transverse bars for truck	
Bolts for same	
Diagonal struts.....	} None
Rivets for same	
Drawplate, front.....	2 ft. x 7' 9" x 3/8"

Frame.—Continued.

	SIZE.
Short do	None
Drawplate, back.....	2' 0" x 7' 9" x $\frac{3}{8}$ "
Centre plate.....	1' 0" x 7' 9" x $\frac{1}{4}$ "
Tie rods.....	1 $\frac{1}{2}$ round, with 1 $\frac{3}{4}$ " ends
Rubbing plate.....	Cast iron 1 $\frac{1}{2}$ " x 8"
Bolts for same	2 thru. and 2 short 1" dia.
Front beam plate.....	$\frac{7}{8}$ " x 11" x 8' 6"
Bolts for same.....	
Draw casting, front.....	
Draw pin.....	
Centre casting, front.....	
Bolts for same.....	
Transverse stays, front truck.....	
Centre casting, back	
Bolts for same	
Rear draw beam.....	
Bolts for same.....	
Packing piece.....	
Bolts for same	
Draw casting, rear	
Footed stay for same.....	$1\frac{3}{4}$ " dia.
Washer, do	
Coupling link.....	
Do pin.....	

Trucks.

	SIZE
Front, style of.....	Centre bearing
Back, do	do and side
Wheels, do	Wrought iron 42" dia.
Diameter and hub sizes.....	
Tyres.....	Approved steel. $2\frac{1}{2}'' \times 5\frac{1}{4}'' \times 3\frac{1}{2}''$ inside dia.
Tyre fastenings.....	Mansell patent clip
Axles.....	4. Wrought iron to specification
Total length \times diameter at middle	$7\frac{1}{2}'' \times 4\frac{3}{4}''$
Journals, diameter \times length \times centres.....	$4'' \times 8'' \times 6\frac{1}{4}''$
Wheel seat, diameter \times length.....	$5'' \times 7\frac{1}{4}''$ with key for wheel
Axle box.....	Cast iron
Bolts, size and centres	
Axle box cover.....	Wrought iron
Brass for axle box.....	Gun metal
Size of brass.....	$1\frac{1}{4}'' \times 7\frac{1}{8}'' \times 4''$
Transverse beams.....	of H. iron $9'' \times 5\frac{1}{4}'' \times \frac{1}{2}'' \times 7\frac{1}{2}''$ @ 150 lbs per yd.
Frame clips	Cast iron - See detail
Side frames, front.....	
Bolts for frame.....	
Side frames, back	
Bolts for frame.....	
Centre Casting, front.....	
Centre bolts.....	
Centre Casting, back.....	
Centre bolts.....	
Transverse springs, front	
Spring saddle	
Do buckles.....	
Do shoes.....	

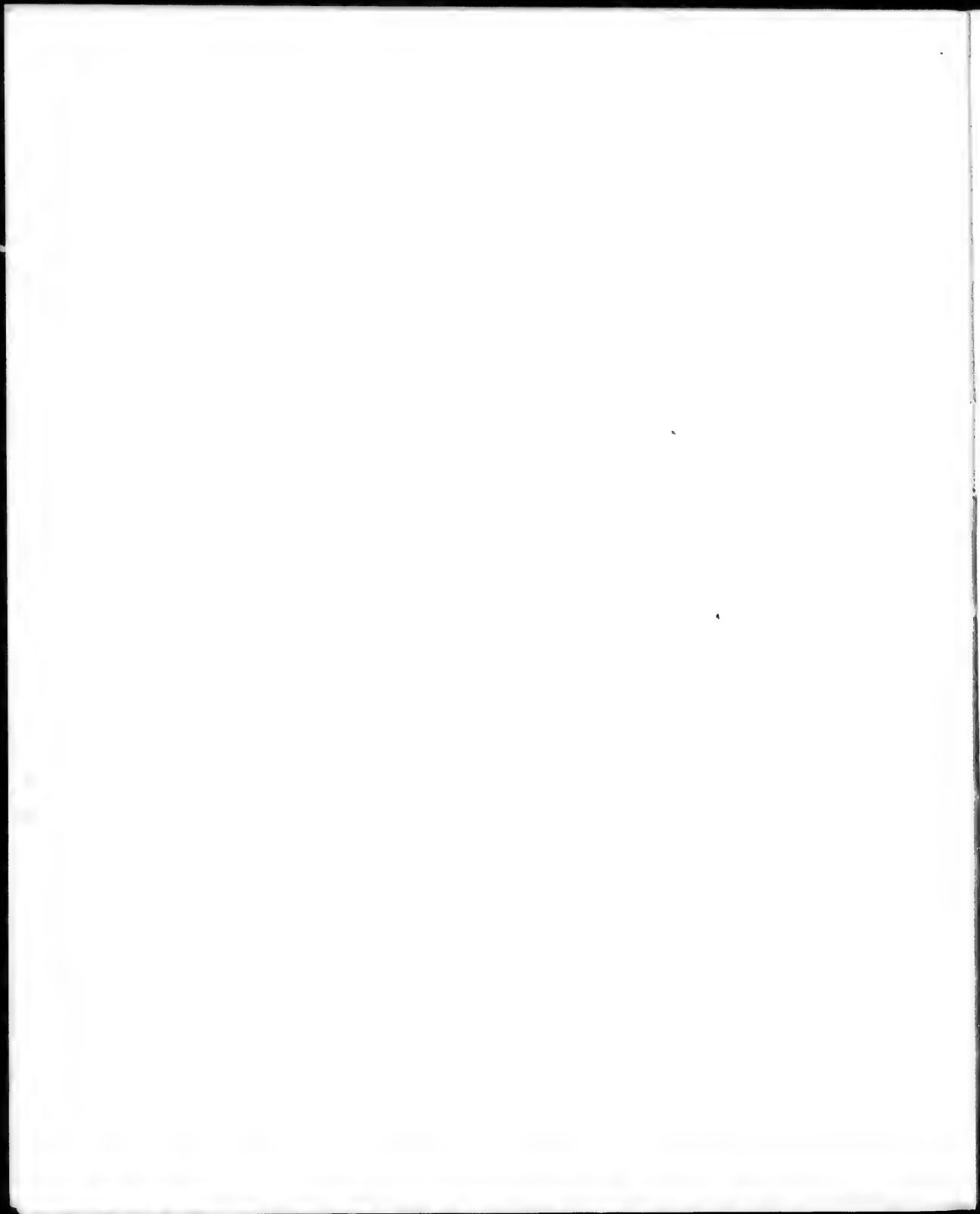
Trucks.—Continued.

SIZE.

Shoe bolts.....	
Centre pin, front.....	
Do back.....	
Side springs.....	
Spring buckles.....	
Do shoes.....	
Centre springs.....	
Spring buckles.....	
Check chains.....	

Brakes.

Number required.....	On all wheels - or 4 sets
Shaft, of wrought iron.....	$1\frac{1}{4}$ " X
Wheel, of cast iron.....	1 of 15" dia. curved spokes $1\frac{1}{8}$ min
Pawl and ratchet.....	
Brackets	
Shaft screw, of cast iron	
Chain, of wrought iron.....	
Rods, of wrought iron.....	all $\frac{3}{4}$ " dia.
Beams, of oak.....	4 of $5\frac{1}{2}$ " X $6\frac{1}{2}$ " X $3\frac{1}{2}$ "
Heads, of cast iron.....	8 of 16" X 3"
Shoes, of cast iron.....	8 of do X do X $1\frac{1}{4}$
Long bolts, for heads.....	8 of $\frac{7}{8}$ " countersunk
Short do do	8 of $\frac{7}{8}$ do
Toggle pins, of wrought iron	8 of $\frac{7}{8}$ " X 10" long
Slings, of wrought iron	8 of 1" dia
Supports, for slings.....	Various see details
Safety links, of wrought iron.....	$\frac{3}{4}$ " dia
Levers, of wrought iron.....	2 of $\frac{3}{4}$ " X $2\frac{1}{2}$ " X 2': 6" centres
Beam washers, of cast iron.....	6 large and 24 small
Beam stirrup, of wrought iron.	2 of $\frac{1}{2}$ " dia. X $8\frac{3}{4}$ " inside length



GENERAL DETAILS OF CONSTRUCTION.

All timber must be of the first quality of its kind, dry, sound, free from knots, shakes or any signs of decay, well and fully seasoned.

Wrought iron, where quality is not stated, must be at least equal to Staffordshire, that is, it must have an ultimate tensile resistance of 20 net tons per square inch of original section when tested in the direction of the grain, with an ultimate elongation of from 10 to 16 per cent., and a contraction at point of fracture of from 8 to 16 per cent., all welds and joints being carefully made, the forgings sound and neatly finished.

Ordinary castings must be from tough grey No. 1 pig iron, smooth, sound, free from sand holes, blow holes, or scoria, and perfect in shape, size and every other respect. The cylinders and slide valves require to be of a much harder quality of iron, in fact, cast as hard as the machine tools will allow of being bored and faced.

All bolts and nuts used must be quite full in size, the thread being cut to "Whitworth's standard" clean and full, so that nuts will not shake; all bolt holes to be fair, directly opposite and perfectly circular. All driving bolts will be one-sixteenth larger in diameter in the body than at the thread, although the sizes figured are those of the screwed portion. Bolts for frame, for motion, and for truck, must be a tight driving fit, the holes being carefully rimered out.

In the construction of the boiler, great care must be used in the bending and setting of the plates, so that they shall be as required, perfectly cylindrical, straight and close fitting. Plates may be punched, but the rivet holes must be fair and opposite or made so by rimering, the use of the drift, under no circumstances, being allowed. The rivets, whose quality must comply to the G. T. Ry. standard rivet specification, must fully fill the holes, and have full-size snap heads properly and soundly set up.

All screwed stays must be of high quality of iron, having an ultimate tensile resistance of 25 net tons per square inch of original section, with an ultimate elongation of from 12 to 20 per cent, and contraction of 16 to 25 per cent. They are to fit so tight into boiler plate that they shall be steam tight before the ends are snapped over; this snapping over to be carefully and neatly done. All riveted joints are to be carefully caulked on both sides or edges, care being taken not to cut or in any way injure the body of the plate. Boiler is rigidly secured to main frame at the cylinder saddle only, and at the other points where its weight is carried by brackets and stays it must be capable of free longitudinal movement, but not of vertical or transverse motion.

No liners of any kind whatever will be allowed in boiler joints or fire box ring joints. Foundation ring must be machine-planed, both inside and outside, and the curved ends carefully finished in a similar manner by slotting machine or by hand. Ashpan dampers must be a careful fit, and as air-tight as possible. All brackets, hinges, rods, levers, and handles required for the independent working of these dampers must be of wrought iron.

All barrel-seams must be double riveted, pitched zig-zag or diagonally. All flanging must be carefully and neatly performed, showing no signs of crack or burning. Corners at points where three thicknesses of metal come together are to be carefully thinned down and neatly set. Angle iron ring to be neatly machine-faced on both inner surfaces, the webs to finish to the thickness shown. Holes for dome and fire door are to be carefully flanged outwards, as shown. All

metal used in boiler must be distinctly branded by the maker, and both metal and tubes must fully comply with the requirements of the G. T. R. standard specifications. Tubes are to be expanded only by the careful use of a tube-expander; outside copper ferrules, 1 inch long, being required at the fire box end. Smoke box door and its ring must be machine-turned, and fitted quite air-tight. Unspecified single riveted joints will have rivets of $\frac{3}{8}$ inch diameter, pitched $1\frac{1}{2}$ inches apart, and a $2\frac{1}{2}$ inch lap of plate.

When boiler is completed and fitted it will be tested with water not warmer than 100° F. to a pressure of 200 lbs. per sq. inch by means of a hydraulic pressure pump, and it is to retain this pressure for 15 minutes, without additional use of pump after this strain is reached. It will also be subjected to a pressure of steam of 170 lbs. per sq. inch, and under both these tests is to retain its shape unaltered and be perfectly tight; this test to be carried out before boiler is cleaded.

Main frame is to be planed at sides, faces of pedestals and all joints and points where cylinder and saddle, motion, and brackets are attached. All holes are rimmed out so that bolts may be a tight and heavy driving fit; cylinders to be additionally secured by steel wedges. Cylinder saddle is to be carefully chipped to fit smoke box. No liner or jointing material will be permitted to be used. The holes through smoke box for passage of exhaust and steam pipes must not be larger than is just necessary to permit their free entrance.

Main frames must be parallel and quite square with each other, and of the same shape and size, and so fitted as to be freely interchangeable in any engines of this class. All fillets and corners carefully rounded to the compound curve shown on drawing.

Wearing surface of motion to be carefully and efficiently case-hardened to a depth of at least $\frac{1}{8}$ inch, and if crank pins are made of iron they also must be satisfactorily case-hardened. Motion brackets to be painted, not polished bright, and the eccentric rods, side rods and connecting rods also are to be painted between the butt ends, these ends alone being bright. Belly plate is to be planed on both sides. All machine and hand work to be done in a careful and workmanlike manner and first-class style, being quite free from coarse tool marks.

Springs to be tempered in oil and to be tested until all camber is taken out and the plates are straight. Wheels and axles are to fully comply with all the requirements of the separate drawings and standard specifications of the G. T. R. Co'y. They are to be so bored and turned that it will require a hydraulic pressure of not less than 40 or more than 60 net tons to force the truck wheels on the axles, and in the case of the driving wheels the pressure must be more than 60 and not more than 70 net tons. The driving wheels to be further secured by a well fitting and tightly driven mild steel key, having a section of $1\frac{1}{2}$ in $\frac{7}{8}$ in. The ends of crank pins to be carefully riveted over on inside of hub after being forced into their seats by a hydraulic pressure of from 30 to 40 net tons. All brasses must be a very tight driving fit in their respective axle boxes.

The double poppet regulator valve and its cage should be cast at the same time and of the same run of hard metal, so that, when in use, the expansion of both may be equal, thus ensuring a tight joint at all temperatures. All rings, and ball and socket joints to be well ground in. Cylinder heads to be ground in; a little linseed oil being all that will be allowed in making the steam joint. If copper wire is used in steam chest joints it must have at least an original thickness of $\frac{1}{4}$ inch. Dry pipe, feed pipe, and other long pipes are to be well stayed and supported. Cab is to be strong and stiff, being well secured to fire-box and foot board, by suitable bent angle irons, plates and stays; it is to have all necessary hardware fittings and side handles. Seats to be formed by locked tool boxes with cushions on them. Cab is to be neatly painted in approved colour and varnished, but if altogether of walnut it may be varnished only.

Boiler barrel is to have one coat of red lead, before being cleaded, and the whole of engine and tender is to have two coats of good oil paint to pattern and sample style supplied, and then be well varnished in two coats. All covers and bands are to be, where possible, left dark and painted, instead of being polished bright.

Push bar is to have hook attachment for tail rope; the signal lamp brackets are to be fixed in front of smoke box and in rear of tender. Long and convenient footsteps are required on both engine and tender. Frost cocks must be arranged so as to clear all pump chambers and pipes of standing water. Water gauge glass is to be set at such a height that when the water falls below sight in tube there shall be 2 in. of water over highest point of crown sheet. Lock-up safety valve must be fixed so as to be completely beyond the control of the engineman. A $\frac{3}{8}$ in. thickening plate must be riveted inside of boiler plate at all points where holes are tapped through for mud plugs, except for those in tube plates. Upon no consideration will the Contractor be allowed to omit large-sized round split pins in ends of truck bolts, motion pins, and any other bolts subject to much movement.

All metal in tender must fully comply with the requirements of the standard G. T. Ry. metal specifications. Tank seams may be lap jointed, the plates must be neatly bevelled and flattened so as to show a perfectly smooth and even surface on the outside, and all the plates are to be perfectly straight on the edge.

A set of iron templates will be supplied free of cost to Contractor at any point upon line of G.T.R. that he may wish them delivered. Their shape and dimensions must be carefully followed as gauges for the finished work.

All moulding patterns used in the construction, will after delivery of engines, if in good condition, be purchased by the G.T.R. Co., for the sum of fifteen-hundred dollars.

Steel plates after being either sheared, punched, bent, or flanged, to be carefully annealed — that is — heated to a low red heat and then cooled slowly and uniformly.

The operation of bending or flanging steel boiler plates must wherever possible be done at one heat, the plate being uniformly heated throughout.

GENERAL CONDITIONS.

The engines and tenders must be made to the dimensions given in the accompanying description to the templates and to the drawings, of which a complete set of tracings will be supplied to the Contractor, who pledges himself to correctly follow these sizes, so that the various parts may be freely interchangeable not only with those he may build, but also with those which the Grand Trunk Railway Company may have built or may build from the same specification. Where dimensions are omitted in this specification they will be found fully detailed in the drawings, and on the drawings themselves the figured dimensions are to be preferred to scale.

The quality of the material used is to be of the make or character specified, and when no such instructions are given, to be the very best of their respective kinds, and the same is required of the workmanship and general fitting. The whole contract is during the course of its manufacture subject to the constant inspection, and also to the ultimate approval (when completed) of the Mechanical Superintendent of the Grand Trunk Railway Company, or his duly accredited Agent, who shall have the power to reject the whole or any part believed in his judgment to be defective in quality of material or workmanship, or not in accordance with this specification or the drawings supplied.

The Contractor agrees to give the resident or other Inspector every possible facility in carrying out any test or experiment that may be required in seeing that the provisions of this specification and the wishes of the purchasers are complied with.

While the foregoing statement sets forth the general details of the engines and tenders, the Grand Trunk Railway Company reserves the option of such minor modifications as may ultimately be found necessary when completing the various detail and working drawings, so long as the general principle and leading dimensions are not interfered with, without rendering themselves liable to any claim for extra payment over and above the contract price agreed upon. The Contractor is not allowed at his own discretion to deviate from this specification and the drawings, without first submitting the proposed change in writing to the approval of the Mechanical Superintendent, and receiving his permission, also in writing, to carry out the same, the risk and charge being borne solely by the Contractor.

Should any part be omitted on drawing or specification the Contractor is not to take advantage of such omission, it being understood and expected that the Contractor will tender for engines and tenders that will be turned out complete and perfect in every respect, and warranted to perform the designed work to the satisfaction of the Grand Trunk Railway Company, represented by its Mechanical Superintendent.

Any defect in either material or workmanship that may show itself during the time occupied in running the 2,000 miles guaranteed is to be remedied by the Contractor, or, at his expense, by the Grand Trunk Company, as they (the Railway Company) may think fit.

Form of Tender for

Engines and Tenders.

do hereby agree to supply the

GRAND TRUNK RAILWAY COMPANY

of Canada with

all complete, in full working or running order, free from
claims for freightage, Customs dues, Patent Right Royalties, or any other charges,

for the sum of

Payment to be made

The first payment not being made until Engine and Tender have run 2,000 miles
in actual work to the satisfaction of the Mech'l. Supt. of the G. T. Ry Co'y.

Delivery to be made on the G.T.R. Track at

the first engine on or before 18

and the last on or before 18

Tenders to be addressed to the General Manager of the Grand Trunk Ry
Co'y at Montreal, and endorsed "Tenders for
Engines and Tenders."